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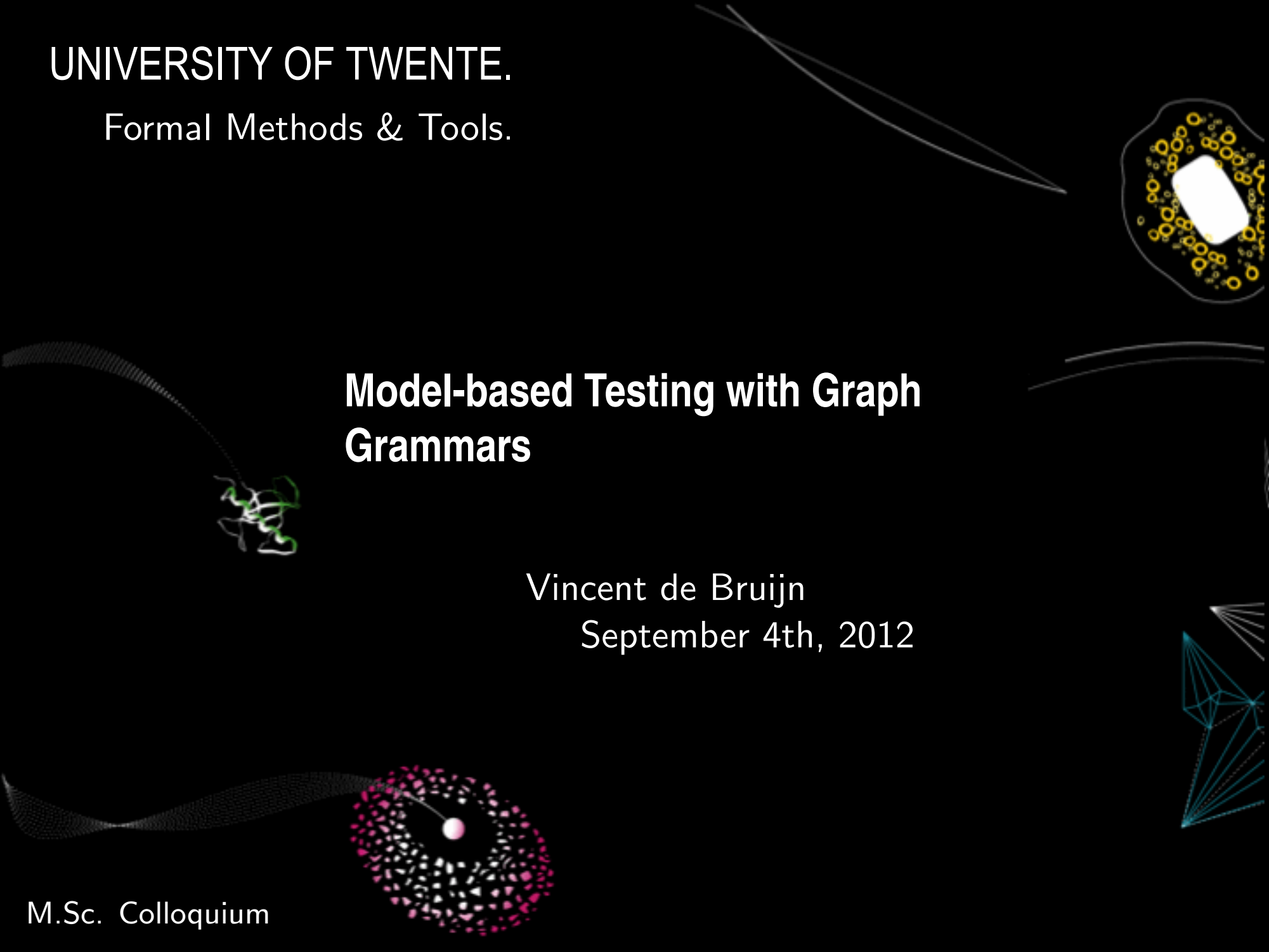
Formal Methods & Tools.



Model-based Testing with Graph Grammars

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M.Sc. Colloquium

Model-based Testing (1/3)

- Why testing?

Model-based Testing (1/3)

- Why testing?
  - List of requirements

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  - Test if implementation satisfies requirements

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  - Test if implementation satisfies requirements
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- Solution
  - Create model from the requirements

Model-based Testing (1/3)

- Why testing?
  - List of requirements
  - Test if implementation satisfies requirements
- Creating tests manually:
  - Error-prone
  - Time intensive
- Solution
  - Create model from the requirements
  - Generate tests automatically using model

Model-based Testing (2/3)

Model

- An abstract representation of the behavior of a system

Plaatje IOLTS hier.

Model-based Testing (3/3)

Plaatje MBT hier.

1. Take possible input from model

Model-based Testing (3/3)

Plaatje MBT hier.

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2. Apply input to SUT

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4. Check if according to model

Model-based Testing (3/3)

Plaatje MBT hier.

1. Take possible input from model
2. Apply input to SUT
3. Observe response(s)
4. Check if according to model
5. Notify tester whether test passed or failed

Model-based Testing (3/3)

Plaatje MBT hier.

1. Take possible input from model
2. Apply input to SUT
3. Observe response(s)
4. Check if according to model
5. Notify tester whether test passed or failed
6. Repeat

Graph Grammars (1/2)

Plaatje graaf, een rule transition, en resultaat graaf hier.

- Graphs represent system states

Graph Grammars (1/2)

Plaatje graaf, een rule transition, en resultaat graaf hier.

- Graphs represent system states
- Graph rules express possible changes to graph

Graph Grammars (2/2)

Plaatje graph rule hier.

- Black and blue parts have to be present in graph

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Graph Grammars (2/2)

Plaatje graph rule hier.

- Black and blue parts have to be present in graph
- Red parts may not be present in graph
- Blue is erased from graph
- Green is added to graph

Tools

- Axini Test Manager (ATM)

Tools

- Axini Test Manager (ATM)
- GRaphs for Object-Oriented VErification (GROOVE)

Research Goals)

- Goals

Research Goals)

- Goals
  - Use GROOVE and ATM to create model-based testing tool with Graph Grammars

Research Goals)

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  - Validate this tool using case studies

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  - Graphs are well-known and often used to represent system states

Research Goals)

- Goals
  - Use GROOVE and ATM to create model-based testing tool with Graph Grammars
  - Validate this tool using case studies
- Motivation
  - Graphs are well-known and often used to represent system states
  - Rules are useful for describing computations

Inhoudsopgave

Inhoudsopgave

Setup (1/2)

- Graphs for humans, transition systems for computers

Plaatje STS hier.

Setup (1/2)

- Graphs for humans, transition systems for computers
- ATM uses *Symbolic Transition Systems*

Plaatje STS hier.

Setup (2/2)

- The tool:

Setup (2/2)

- The tool:
  1. creates STS from the GG in GROOVE

Setup (2/2)

- The tool:
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  2. sends STS to ATM

Setup (2/2)

- The tool:
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  2. sends STS to ATM
  3. does model-based testing in ATM

Setup (2/2)

- The tool:
  1. creates STS from the GG in GROOVE
  2. sends STS to ATM
  3. does model-based testing in ATM
- Step number 1 main part of this research.

Inhoudsopgave

Point Algebra

All data values mapped to one value. Apply to GG: STS structure revealed

Rule Inspection

Parse guards and updates from the rules.

Constraints

1. Variables have to be unique

one picture here with all mistakes.

Constraints

1. Variables have to be unique
2. Variables cannot be part of NACs

one picture here with all mistakes.

Constraints

1. Variables have to be unique
2. Variables cannot be part of NACs
3. Structural constraints on node creating rules

one picture here with all mistakes.

Inhoudsopgave

Model Examples

- 4 small examples used:

Model Examples

- 4 small examples used:
  1. a boardgame

Model Examples

- 4 small examples used:
  1. a boardgame
  2. a puzzle

Model Examples

- 4 small examples used:
  1. a boardgame
  2. a puzzle
  3. a reservation system

Model Examples

- 4 small examples used:
  1. a boardgame
  2. a puzzle
  3. a reservation system
  4. a bar tab system

Case study (1/3)

Introduction to case study

Case study (2/3)

Show a few rules, explain model

Case study (3/3)

Explain results, show effectiveness of behavior-driven modelling

Inhoudsopgave

Conclusion

- Created a tool for model-based testing with Graph Grammars

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- Transformation needs to be extended: complex data structures

Conclusion

- Created a tool for model-based testing with Graph Grammars
- Transformation needs to be extended: complex data structures
- Modelling behavior with GGs is effective